McCoy/PPR-1

OFFICE OF MANNED SPACE FLIGHT PROGRAM DIRECTIVE	M-D MA 1400.046 (Project)	DATE August 15, 1966

APOLLO PROGRAM DIRECTIVE NO. 22

TM061-001-1A

TO: DISTRIBUTION FROM:

APOLLO PROGRAM DIRECTOR

SUBJECT: Apollo Program Flight Mission Directive for Apollo-Saturn 501 Mission

References: (a) MSFC Flight Mission Directive/Apollo-Saturn 501, dated Jan. 14, 1966
(b) AS-501 Spacecraft Reference Trajectory dated Nov. 1, 1965
(c) Apollo Mission Data Specifications, Apollo-Saturn 501, dated August 26, 1965
(d) Mission Requirements for Apollo Spacecraft Development Mission, Apollo-Saturn 501/502 Revision, dated May 3, 1966

1.0 MISSION PURPOSE

1.1 General: The Apollo-Saturn 501 Mission is an unmanned elliptical earth orbital flight.

1.2 Purpose: The purpose of the AS-501 mission is to develop the Saturn V launch vehicle for manned flights and to verify the adequacy of the Block II CM heat shield at lunar reentry velocities.

1.3 Primary Objectives:

(a) The primary objectives of the AS-501 mission shall be those identified in the Apollo Flight Mission Assignments, SE 010-000-1. When appearing in the Mission Directive, they may be amplified but not modified, as required by the Centers. The primary objectives are those which are mandatory. Malfunctions of spacecraft or launch vehicle systems, ground equipment or instrumentation which would result in failure to achieve these objectives will be cause to hold or cancel the mission until the malfunction has been eliminated.

(b) The AS-501 Mission Primary Objectives are as follows:

1. Demonstrate the structural and thermal integrity and compatibility of the launch vehicle and spacecraft. Confirm launch loads and dynamic characteristics.

2. Demonstrate separation of:

   a. S-II from S-IC (dual plane).

   b. LES and Boost Protective Cover from CSM.

   c. S-IVB from S-II.

3. Verify operation of the following subsystems:

   a. Launch vehicle: propulsion (including S-IVB restart), guidance and control, and electrical systems.

   b. Spacecraft: CM heat shield (adequacy of Block II design for entry at lunar return conditions), and selected subsystems.

4. Evaluate performance of the space vehicle EDS in an open-loop configuration.

5. Demonstrate mission support facilities and operations required for launch, mission conduct, and CM recovery.

1.4 Experiments: There are no experiments planned for AS-501.

2.0 GENERAL FLIGHT PLAN

2.1 Launch Vehicle Powered Flight: AS-501 will be launched from Pad 39A in the Merritt Island Launch area. The initial flight azimuth will be 72° E of N. The first stage trajectory will be determined by programmed autopilot control with open-loop guidance. The LES will normally be jettisoned approximately 35 seconds after S-IC separation. The nominal S-II powered flight will last approximately 360 seconds during which time the guidance and control commands will be generated by the IU. Insertion into a 100 n.m. parking orbit will be accomplished by an S-IVB burn of approximately 170 seconds duration. After approximately two revolutions, the S-IVB will be restarted and operated until fuel depletion

occurs using a non-optimum S-IVB steering profile. The profile required is an earth elliptical trajectory with an apogee altitude of approximately 9,000 n.m. Following S-IVB cutoff, the CSM and the S-IVB will coast for a period of approximately two hours during which time the vehicle attitude will be maintained by the S-IVB-IU. At the end of this two hour coast period, the CSM will be separated from the S-IVB.

2.2 Spacecraft Flight Profile: Approximately 2-1/2 hours after CSM separation from the S-IVB, the SPS will be ignited accelerating the spacecraft to an inertial entry velocity of approximately 36,000 ft/sec. The CM will reenter in a lifting condition that will result in a maximum entry heat rate of approximately 580 BTU per sq. ft/sec and a heat load of approximately 33,200 BTU/sq. ft.

2.3 Recovery: Normal recovery of the command module is planned to occur approximately 550 nautical miles north of Hawaii. Backup recovery is required in the event of SPS failure to fire.

2.4 Payload Requirement: The weight of the CSM, LTA, and adapter just prior to CSM/S-IVB separation will be approximately 85,000 pounds. The launch vehicle payload capability will exceed the CSM, LTA, and adapter separation weight requirement by at least the amount required to carry the LES until jettisoned.

2.5 Mission Support Requirements: These requirements will be supplied in "Program Support Requirements" document (PSRD) to be issued by the Operations Support Requirements Office, Mission Operations, OMSF, approximately six months prior to launch.

3.0 CONFIGURATION

3.1 Launch Vehicle: The AS-501 launch vehicle will be the standard operational design with the following major exceptions:

(a) R&D instrumentation in S-IC, S-II, S-IVB, and IU.

(b) R&D structure in S-IC and S-II stages.

(c) Lower nominal thrust and Isp in S-IC, S-II, and S-IVB stages.

3.2 Spacecraft: Airframe 017 will be used for mission AS-501. It will be the Block I CSM design with the following exceptions:

(a) UHF and S-band antennas modified to reflect Block II configuration.

(b) Partial SCS, and ECS.

(c) No couches or crew restraints.

(d) No crew provisions.

(e) Partial instrument panel.

(f) R&D instrumentation added.

(g) Programmer installed.

(h) Simulated Block II heat shield.

(i) Simulated Block II umbilical in addition to active Block I umbilical.

A LEM test article (LTA-10R) will be used in place of the operational LEM. An operational spacecraft LEM adapter (SLA-8) will be used.

4.0 SUPPORTING GROUND TEST CONSTRAINTS

4.1 Qualification: Major components of the launch vehicle critical to the accomplishment of the Apollo-Saturn 501 mission objectives will be ground qualified and acceptance tested prior to launch. All major ground test anomalies will be resolved prior to launch.

4.2 Launch Vehicle: The following major stage and vehicle ground tests will be performed to the extent required to support the Apollo-Saturn 501 mission:

(a) S-IC, S-II, S-IVB structural, battleship/all systems, and acceptance tests.

(b) IU vibration, systems and acceptance tests.

(c) Vehicle dynamic tests.

(d) GSE pre-use acceptance tests and interface compatibility tests.

4.3 Spacecraft: The following major spacecraft ground tests will be performed to the extent required to support the Apollo-Saturn 501 mission:

(a) All CSM subsystem and component certification ground testing required to support the AS-501 mission.

(b) AFM-017 acceptance tests.

(c) GSE pre-use acceptance tests and interface compatibility tests.

4.4 Certification: A Certificate of Flight Worthiness (COFW as outlined in Apollo Test Requirements NPC 500-10 dated May 20, 1964) for each stage, IU, and module is required prior to shipment from the factory and after static firing if appropriate. Final updated and signed COFW's by the program managers will be required at the Flight Readiness Review and close out of open items prior to launch will be in accordance with Apollo Program Directive No. 15 dated January 25, 1966.

5.0 RESPONSIBILITIES

5.1 OMSF:

(a) The Apollo Program Director is responsible for overall management of the space vehicle development including definition of mission objectives, the flight hardware configuration, supporting ground test constraints, resolution of prior flight test constraints, and integration and checkout of the space vehicle prior to launch.

(b) The Missions Operations Director is responsible for coordination of all mission operations planning activity and for insuring that all requirements, plans, schedules, procedures, and directives required to conduct the mission are generated. Overall organizational responsibilities and relations are given in Apollo Program Development Plan MA 001.000-1, Chapter 14.

5.2 MSFC:

(a) MSFC is responsible for the development of the AS-501 launch vehicle and engines and for the associated ground support equipment.

(b) MSFC is responsible for the stages and stage associated GSE checkout and acceptance and delivery of the stages and GSE to KSC.

(c) MSFC is to provide the technical support to KSC as required during the acceptance, pre-launch checkout, and the launch phase of the mission.

5.3 MSC:

(a) MSC is responsible for the development of the spacecraft for the AS-501 mission and for the associated spacecraft GSE.

(b) MSC is responsible for the factory checkout and delivery of spacecraft modules and associated GSE.

(c) MSC is to provide the technical support to KSC as required during the acceptance, checkout, pre-launch, and launch phases of the mission.

(d) MSC is responsible for providing a technical support team comprised of subsystem specialists who will support the mission in real time and form the nucleus of the MSC flight evaluation team.

5.4 KSC:

(a) KSC is responsible for the development and activation of the launch and checkout activities.

(b) KSC is responsible for GSE preparation and pre-launch checkout of the launch vehicle and spacecraft as delegated by the Centers.

(c) KSC is responsible for the task of physically integrating and checking out the total space vehicle with technical support from MSC and MSFC as required.

6.0 IMPLEMENTATION

The MSFC Mission Directive, reference (a), which provides the specific references necessary to carry out the launch vehicle phase of the mission is considered an integral part of this Mission Directive and is approved.

In lieu of an MSC Mission Directive, the MSC working documents covering mission requirements, specifications, and spacecraft trajectory information for the AS-501 mission (references b, c, and d) are considered integral parts of this Mission Directive.

Subsequent changes and future revisions to the MSFC Mission Directive and to the MSC working documents noted above which conflict with the requirements stated herin will require coordination between the Centers and the review and approval of the Apollo Program Director. Other revisions to the MSFC Directive or the MSC working documents will be coordinated between Centers as required with copies submitted to the Director, Apollo Test, Code MAT, for information.

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